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Acid Deposition Research Program

Alberta Government/Industry
Acid Deposition Research Program

First Annual Report

January 1, 1983 to March 31, 1984

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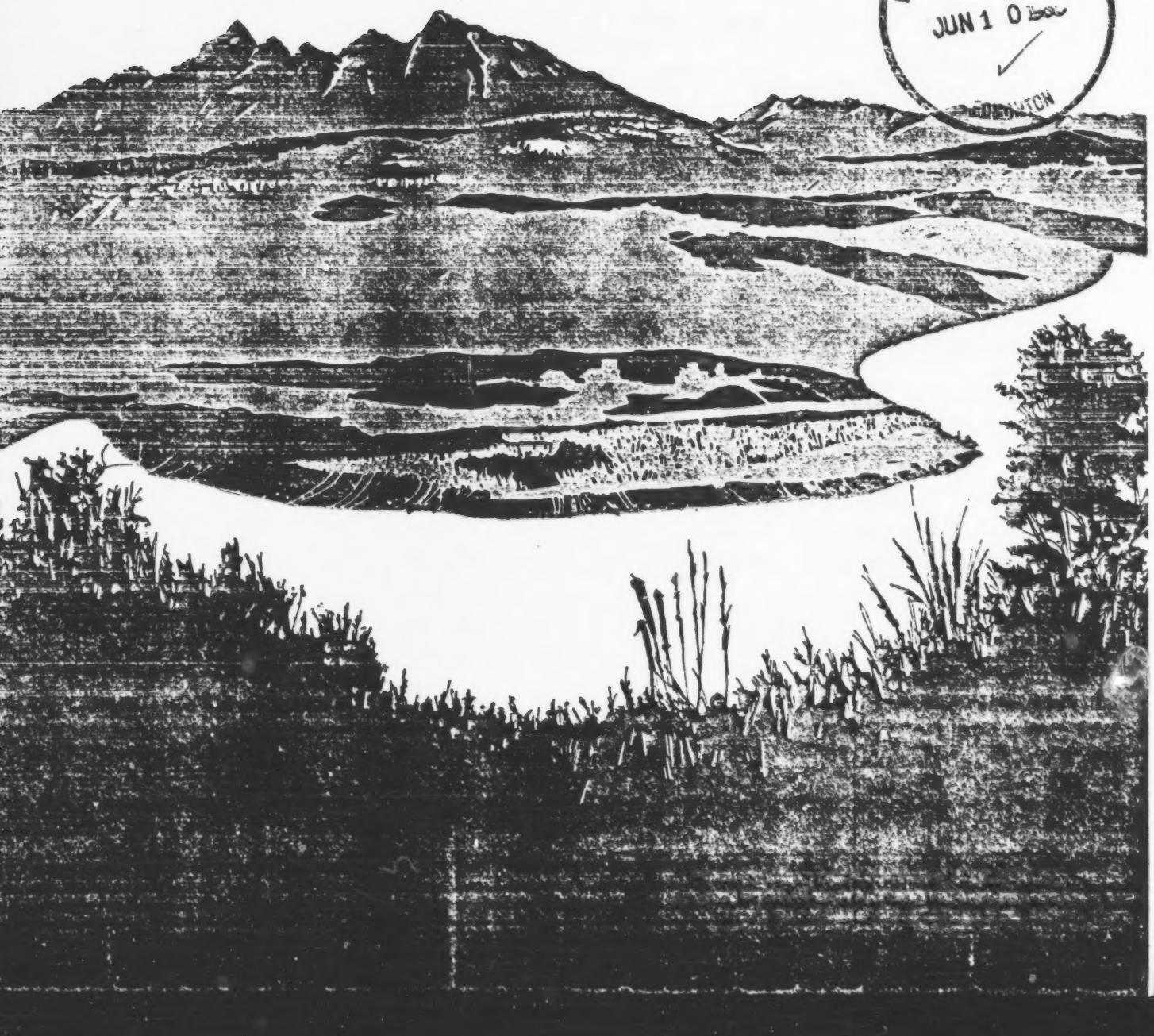

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Co-Chairmen's Report

We are pleased to offer this review of the activities of the Acid Deposition Research Program (ADRP) during our first fiscal year. We believe this report will provide an overview of the program – its goals, its organization, and its approach, as well as a record of our efforts.

The Acid Deposition Research Program is in its formative stages. The work being done in these early stages, however, is critical. It is critical to the success of this long-term, highly comprehensive assessment of the environmental impact of acid-forming gases in Alberta.

The Formative Stages Critical to Program Success

Work accomplished between January 1, 1983 to March 31, 1984 was done with an awareness that the foundation for this long-term project was being laid. Steps taken to date, we believe, have established the atmosphere of scientific credibility essential to the success of this program.

Although research on acid forming emissions in Alberta has been conducted by both industry and government for decades, ADRP is the most comprehensive study by far. It evolved from the work of the Steering Committee on Acid Gases in the Environment (SCAGE) formed in 1979 by the Alberta Petroleum Industry Government Environmental Committee (APIGEC). APIGEC was composed of representatives from Alberta Environment, the Energy Resources Conservation Board, Energy and Natural Resources, the Canadian Petroleum Association and other industry representatives. APIGEC gave SCAGE its mandate to develop a co-ordinated research program to determine the consequences, both positive and negative, of acid deposition in Alberta. In formulating its recommendations, the committee would have to address the concerns of the petroleum industry, the utility industry, the provincial government, and the public. Recruiting about 40 experts from Alberta's industry, government and universities, SCAGE created three technical subcommittees to deal with the effects of acid gases on environmental systems and human health.

In 1981 SCAGE submitted its report. Its recommendation was clear. A co-ordinated, interdisciplinary, *holistic* research plan was needed to assess the impact of acid deposition in Alberta. The underlying and most important feature of the report was its holistic approach to problem-solving: its basic assumption was that all components of ecosystems are interrelated. Thus it is only by understanding chemical and biological processes within, between, and among ecosystems that researchers can hope to assess the impacts of acid deposition.

The endeavors of SCAGE began to bear fruit in April 1983 when an agreement was signed between the Alberta Government; the Canadian Petroleum Association; the Independent Petroleum Association of Canada; NOVA, An Alberta Corporation; Petro-Canada; and Alberta's three principal electrical utilities.

The agreement committed $8 million to a seven-year research program – the most ambitious ever undertaken in Alberta. It is ambitious in the best sense of the word. Its aims are to clarify the effects of acid deposition in order to protect all of Alberta: its industry and agriculture, its wide open spaces and its people.

A distinctive feature of ADRP is the development and funding of research in two major areas: biophysical and human health. Only by combining these two components can the program achieve its holistic goals. The biophysical research program will investigate the impact of acid deposition on vegetation, soils and water. A medical research program will look into the effects on human health.

The program will commission specific acid gas-related studies, publishing and providing interim reports to the public as research progresses. Research will focus on two principal gas groups: oxides of sulphur (SOx) and oxides of nitrogen (NOx). The ADRP will commission studies into the generation, transfer, transportation and deposition of these and other minor gases. A major report outlining the program's findings, conclusions and recommendations will be released at the conclusion of the project.

Despite the fact that Alberta's industrial emissions and regulations are among the world's most stringent, public concern persists about the possible impact of emissions on air, water, land and human systems. The Acid Deposition Research Program proposes to determine and clarify the justification for public concern, and where possible, to identify solutions.

The Workshops: A Commitment to Scientific Integrity

To ensure top calibre scientific design and impartiality, ADRP invited internationally-recognized scientists to two task-oriented workshops. These preliminary workshops, held to establish a work plan for the extended project, have drawn on the best expertise available.

The purpose of the workshops was to develop a multidisciplinary approach to the study. As the following summaries make clear, both the biophysical and human health research committees voiced their commitment to this approach. The biophysical researchers held their workshop in October 1983; the human health researchers in January 1984. The executive summaries of these proposals have been reproduced in this annual report as they were presented to the sponsors, without editorial changes.

Co-chairmen of the biophysical workshop were Dr. Sagar Krupa of Alberta Environment (currently with the University of Minnesota), and Dr. Dennis Parkinson of the Kananaskis Research Centre. Their counterparts at the human health workshop were Dr. Don Johnston of Dome Petroleum and Dr. Bob Rogers of Workers' Health, Safety and Compensation (now at Concordia Edmonton).

Public Involvement and Communications: An Essential Element

In addition to the two scientific workshops, planning for an ADRP sponsored communications workshop was undertaken during the fiscal year. This workshop was held in April, 1984 under the Co-Chairmenship of Peter McKenzie-Brown of the Canadian Petroleum Association and Christine Staddon of Alberta Environment. Although the workshop itself was held outside the fiscal year, we feel a summary of its recommendations is important to the overall understanding of the ADRP.

Ron Findlay

Because of high public interest in acid related issues, the Members Committee felt it was essential to incorporate public involvement and communications into ADRP activities.

The workshop identified communications objectives as well as means of establishing a flow of two-way communications: getting information **to** the public as well as obtaining information **from** the public. Recommendations included the establishment of a Public Advisory Board and hiring a communications co-ordinator. Both recommendations are now being implemented.

The ADRP is committed to the principle of communication of its purposes, goals and research findings to the public. It will also provide opportunities for the public to offer input. The activities of our first fiscal year demonstrated the commitment to this approach.

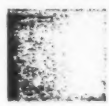
Laying the foundations, then, was the major focus of this past fiscal year. With this accomplishment, the current year's activities can focus on the selection of a prime contractor for the program, and the launching of the field research.

ADRP People

Representing Alberta's many environmental groups as the Members Committee began to grapple with issues of public involvement was Rocky Mountain House veterinarian Dr. Martha Kostuch. Offering valuable and informed opinion from the Energy Resources Conservation Board was Ed Brushett.

Other Members Committee members were Treasurer Bill Ross, Esso Resources Canada; Secretary Dr. Harby Sandhu, Alberta Environment; Dr. Percy Sims, Alberta Environment; Jock Poyen, the Independent Petroleum Association of Canada; Mike Robertson, Petro-Canada; Phil Mason, NOVA, An Alberta Corporation; and Dr. John Railton, TransAlta Utilities.

In closing, we would be remiss if we did not thank these and the many others who have contributed unstintingly to the success of these programs to date. We express our warm and sincere appreciation. Results from the ADRP cannot be predicted, but there is little doubt that the program will extend the body of scientific knowledge about the impacts of acid deposition – perhaps contributing to global solutions to this environmental concern. Achieving this goal is the commitment made by the sponsors of this program. Working to this end is the priority.



Ron Findlay, Co-Chairman
Manager Environmental Affairs
Amoco Canada Petroleum Company Ltd.

Jerry Lack, Co-Chairman
Branch Head, Air Quality Control Branch

Jerry Lack

ADRP: Organization

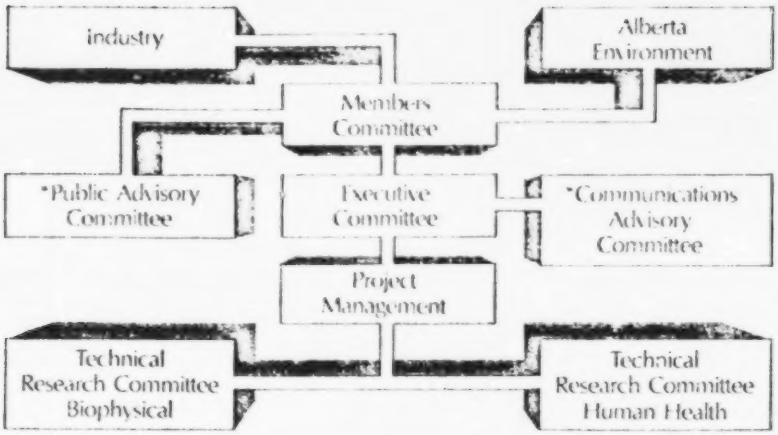
A. Objectives

1. To provide a comprehensive understanding of the effects and consequences of acid-forming gases on the environment.
2. To provide a scientific basis for sound, long-term environmental management and regulatory control with respect to acid forming gases.
3. To disseminate such information among members, to the public and to government bodies.
4. To undertake any research deemed appropriate.
5. To encourage and include opportunities for public representation in the ADRP.

B. Membership and Percentage Participation

Initial Members	Percentage Participation for Voting and Funding	Number of Voting Representatives
The Minister	50.00	1
Canadian Petroleum Association	34.20	1
Independent Petroleum Association of Canada	5.27	1
Utilities Group - TransAlta Utilities Corporation - Alberta Power Limited - The City of Edmonton	5.27	1
Petro-Canada Exploration, Inc.	2.63	1
Nova, An Alberta Corporation	2.63	1
Energy Resources Conservation Board	—	—
Public Member	—	—
TOTAL	**100.00%**	**6**

C. Alberta Government/Industry Acid Deposition Research Program Organization



*Established in the 1984-85 fiscal year.

Members Representatives:

Alberta Dept. of Environment
CPA
] Co-Chairmen

IPAC
PetroCan
Nova
Utilities
ERCB
Public

Executive Committee:

Alberta Dept. of Environment
Industry
] Co-Chairmen

Secretary
Treasurer

Technical Committees:

Industry
Government
] Co-Chairmen

D. Members Committee Representatives 1983-84

R.L. Findlay (Co-Chairman)
Manager, Environmental Affairs
AMOCO Canada Petroleum Co. Ltd.

J.C. Lack (Co-Chairman)
Head, Air Quality Control Branch
Pollution Control Division
Alberta Environment

W.K. Ross (Treasurer)
Senior Engineer Specialist
Development Division
Esso Resources Canada Ltd.

H.S. Sandhu (Secretary)
Senior Research Manager
Research Management Division
Alberta Environment

J. Poyen
Manager, Economics Director
Independent Petroleum Association of Canada

C.P. Mason
Manager, Environmental Affairs
NOVA

H.P. Sims, Director
Research Management Division
Alberta Environment

M.R. Robertson
Manager, Environmental Affairs
Environmental and Social Affairs
Petro-Canada

J. Railton
Manager, Environmental Planning
TransAlta Utilities

E. Brushett
Manager, Environmental Protection
Energy Resources Conservation Board

M. Kostuch
Public Representative

Summary of the Biophysical Workshop

The document Biophysical Research Plan describes a comprehensive, integrated research program on the emission, dispersion, deposition, and ecological effects of acidic and acidifying pollutants. This program emphasizes the need for close collaboration among investigators from many different scientific disciplines.

The proposed program will extend over a five-year research phase, after an initial period of study site(s) identification and methodology development. In this initial period, a critical focus will be on implementing the multidisciplinary framework required to form a coherent program from components representing specialities in air quality, vegetation effects, soil effects, and aquatic effects. Most of these specialities are represented in the Alberta environmental research community, and this is seen as a factor likely to contribute strongly to the success of the overall program. To a considerable extent, the success of this program depends on the ability to bring these existing skills together in a manner that will assure co-ordinated direction toward the jointly-recognized goal of an essentially holistic program. The development of an integrated transport, deposition, and effects model is seen as a goal of this program, with model subroutines constituting individual targets for research in the separate disciplines. The detailed structure of such a model is not specified but is seen as an important first goal of the initial work under this program.

The program also calls for an additional one-year period for final data analysis, synthesis, and report preparation.

The opportunities available in Alberta for this kind of work combine to make studies of environmental impact especially attractive. The ready availability of much of the required expertise is not the only reason for identifying Alberta as an especially advantaged experimental location. The province appears to be exposed to relatively clean incoming air which is modified by emissions from sources which are already well documented and regulated. The research interest and active involvement of Alberta industry and government is an especially welcome and critical feature. Finally, the size of the province is such that many potential experimental locations can be identified, from which suitable candidates should be easily selected.

Sites for effects work should also be sites for air quality, precipitation quality, and related meteorological investigation. Data obtained should be adequate for inferring time-varying surface fluxes of the pollutants deemed to be of greatest importance (e.g., SO_2, NO_x, and O_3). The surface fluxes, or dry deposition rates, form a direct link between air concentrations and pollutant uptake rates. Only slightly less direct is the link between effects and components brought down by rain and snow. Dose/response models presently under development are starting to take the time-varying nature of atmosphere/canopy interaction into account. The present program is designed to provide the data required by this new generation of dose/response models as well as the longer-term averages needed by older (but still more conventional) approaches.

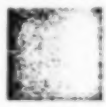
Air quality and source characterized data bases generated during the study will serve as input to source apportionment techniques to determine the sources of the chemical species that impact the Alberta ecosystems. Air quality (and precipitation quality) data will also be obtained on a regional basis, to provide documentation of the background characteristics in which the effects studies are conducted. This information will also assist in separating regional versus local emissions, to inflow of pollution across upwind provincial boundaries, and to export downwind.

A key component of the proposed research plan is to conduct vegetation effects studies at a small number of well-instrumented sites selected to provide a range of pollutant-exposure conditions under natural circumstances. Studies of effects in conditions of natural exposure should be accompanied by open-top chamber studies at one of these sites, thus providing independent information on dose/response relations at the same location. The focus of these studies would be on both forests and crops, although it is clear that chamber studies are most applicable in the latter case.

Soil studies will be conducted in concert with the investigations of vegetation effects. Soil samples will be exchanged among the sites selected for vegetation studies. The emphasis of biological effects studies will be on soluble species in the soil, on soil microbiology, and on root biomass.

Aquatic research will look for evidence of decreased pH and increased levels of potentially toxic metals. The potential sensitivity of aquatic receptors will be assessed, and if alkalinity gradients are evident, the contribution of atmospheric acid deposition will be determined by analysis of observations made in conditions of different acid loading.

The probability of success of the research plan set forth here is dependent on the degree of integration achieved in its management. It cannot succeed if it is separated into independent, unco-ordinated sectors. It should be initiated as a single project with a single prime contractor who will submit a single, integrated proposal. The contractor can and should bring in appropriate research scientists or research groups from outside the contractor's own organization to provide specific skills and/or execute specific components of the total program. However, the prime contractor must retain authority, responsibility, and accountability for the entire project, and for synthesizing all components into a holistic view of the data and analysis in the final report.



Summary of the Human Health Workshop

The experts' recommendations at the Acid Deposition Research Program (ADRP) Human Health Workshop are based on two premises:

1. that the potential impact of acid deposition on the health of Albertans requires urgent and concerted action; and
2. that public complaints of health problems are a valid starting point.

After a thorough and complete review of available documentation the scientists concluded that the research completed so far in the province does not provide the necessary information on which to base concrete research proposals. A comprehensive medical diagnostic review was recommended to be undertaken to determine the nature of long-standing health complaints.

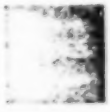
The experts also recommended the following:

1. Epidemiology Studies based on:
   a) community epidemiology using cross-sectional studies followed by prospective studies;
   b) occupational epidemiology of both high and moderate exposures; and
   c) exposure monitoring using environmental monitoring at sites selected by epidemiologists; human biological monitoring and screening: and methods assessment.
2. Clinical Service and Field Research Program through four approaches:
   a) a community input program using a toll-free 'hotline';
   b) a central repository of environmental and health effects data;
   c) an environmental health medical referral unit such as a tertiary referral centre attached to a university hospital; and
   d) a field investigation team to immediately follow up emergencies or unusual pollution episodes.
3. Human Clinical Research and Animal Toxicology: to provide new knowledge on the toxicity of unstudied compounds or mixtures of compounds.
4. Behavioral-Environmental Health Issues. The valid information base required for informed decision-making should be developed through four mechanisms:
   a) surveying individual perceptions;
   b) investigating the influences of odour in reporting symptoms;
   c) conducting an historical study of factors leading to community conflict; and
   d) periodically sampling residents in affected and non-affected regions.

The experts identified three organizational components which are necessary to preserve and enhance government and industry credibility:

1. external scientific control of the program through the Scientific Advisory Body (SAB);
2. a referral system for study participants who may have undiscovered illnesses; and
3. community liaison through public representatives who are fully accredited members of all standing committees connected with ADRP.

These recommendations provide not only specific research projects to be conducted within ADRP over the next six years but also a blueprint for a general approach that can be used in resolving other environmental health problems associated with the development of Alberta's natural resources.



Financial Statement

Acid Deposition Research Program

Statement of Operations and Surplus
For the Fifteen Months from January 1, 1983 to March 31, 1984

	1984
Revenue	
Members	$150,000
Interest	6,873
	$156,873
Expenditures	
Acid deposition workshops	78,997
Consultants	9,025
Administration	9,008
	$ 97,030
Excess of revenue over expenditures for the period and surplus at end of period	**$ 59,843**

Balance Sheet
March 31, 1984

Assets	1984
Current	
Cash and short term deposits	$159,576
Accounts receivable	1,500
	$161,076
Liabilities and Surplus	
Current	
Accounts payable and accrued charges	$ 3,833
Membership revenue received in advance	97,400
Surplus	59,843
	$161,076

On behalf of the Members Committee:

K.L. Gill — Member

William K. Ross — Member

Notes to Financial Statements
March 31, 1984

1. Operations and significant accounting policies

The Acid Deposition Research Program was established on January 1, 1983 to perform studies and conduct various workshops and other activities on behalf of its members who are principally companies and organizations operating in the natural resources and energy sectors. The majority of the Program's revenue is derived from, and expenditures are incurred on behalf of, its members.

The financial statements of the Program have been prepared by management in accordance with accounting principles that are considered appropriate for organizations of this nature. The financial statements have, in management's opinion, been properly prepared within reasonable limits of materiality and within the framework of the accounting policies summarized below.

a) Revenue

The Program accounts for revenues using the accrual method of accounting except that interest earned on surplus cash is recognized on the cash basis.

b) Income tax status

The Program is a non-profit organization and as such is exempt from income tax.

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